

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**Applicant(s):** Ted Christopher                      **Examiner:** Not Assigned  
**Serial No:** Not Assigned                      **Art Unit:** Not Assigned  
**Filed:** Herewith                      **Docket:** 9872Y  
**For:** FINITE AMPLITUDE DISTORTION-                      **Date:** March 23, 2004  
              BASED INHOMOGENOUS PULSE ECHO  
              ULTRASONIC IMAGING

Commissioner for Patents  
P. O. Box 1450  
Alexandria, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT**

Sir:

In accordance with 37 C.F.R. §§ 1.97 and 1.98, it is requested that the following references, which are also listed on the attached Form PTO-1449, be made of record in the above-identified case.

1. Japanese Patent Application Publication Kokai: Heisei. 8-294487, published November 12, 1996;
2. Averkiou, et al., (1995), "Measurements of Harmonic Generation in a Focused Finite-Amplitude Sound Beam", J. Acoust. Soc. Am. 98(6), pp. 3439-3442;
3. Baker, et al., (1997), "Nonlinear Propagation Applied to the Improvement of Resolution in Diagnostic Medical Ultrasound", J. Acoust. Soc. Am. 101(1):143-154;

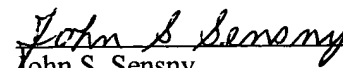
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I hereby certify that this correspondence is being deposited with the United States Postal Service Express Mail Post Office to Addressee service under 37 C.F.R. §1.10 on the date indicated above and is addressed to the Commissioner for Patents, Box 1450, Alexandria, VA 22313-1450.

Dated: March 23, 2004

  
John S. Sensny

4. Baker, et al., (1995), "Non-Linear Propagation Applied To The Improvement Of Lateral Resolution In Medical Ultrasound Scanners", 1995 World Congress On Ultrasonics, pp. 965-968;
5. Baker, et al., (1988), "The Nonlinear Pressure Field of a Plane Circular Piston: Theory and Experiment", J. Acoust. Soc. Am. 84(4);
6. Bjorno L. et al., (1982), "Nonlinear Focusing Effects in Ultrasonic Imaging", Ultrasonics Symposium Proceedings, Vol. 2:659-662;
7. Chang, et. al., (1994), "Second Harmonic Imaging and Harmonic Doppler Measurements with Albunex", 1994 Ultrasonics Symposium, pp. 1551-1554;
8. "Errors in Attenuation Measurements Due to Nonlinear Propagation Effect," Zeqiri, J. Acoust. Soc. Am. 91 (5), pp. 2585-2593, May 1992;
9. "Harmonic Generation in Finite Amplitude Sound Beams from a Rectangular Aperture Source," Kamakura, et al., J. Acoust. Soc. Am. 91 (6), pp. 3144-3151, June 1992;
10. "The Enhancement of Second Harmonic Generation In Ultrasonic Microscopic Observation By Triple Transition," Din, et al., 1993 Ultrasonic Symposium, pp. 575-578;
11. "Non-Linearity and Finite Amplitude Effects," European Journal Of Ultrasound, 1 pp. 219-215, 1994;
12. "Time-Shift Compensation of Ultrasonic Pulse Focus Degradation using Least-Mean-Square Error Estimates of Arrival Time," Liu, et al., The Journal of the Acoustical Society of America, Vol. 95, No. 1, pp. 542-555, January 1994;
13. "Adaptive Focusing in Scattering Media through Sound-Speed Inhomogeneities: The van Cittert Zernike Approach and Focusing Criterion," Mallert, et al., J. Acoust. Soc. Am., 96 (6), pp. 3721-3732, December 1994;
14. "Wavefront Amplitude Distribution in the Female Breast," Zhu, et al., J. Acoust. Soc. Am., 96 (1), pp. 1-9, July 1994;
15. "An Experimental Investigation of the Nonlinear Pressure Field Produced by a Plane Circular Piston," TenCate, J. Acoust. Soc. Am. 94 (2), Pt. 1, pp. 1084-1089, August 1993;
16. "New Approaches to Nonlinear Diffractive Field Propagation," Christopher, et al., J. Acoust. Soc. Am. 90 (1), pp. 488-499, July 1991;

17. "Imaging the Acoustic Nonlinearity Parameter with Finite-Amplitude Sound Waves: The Difference-Frequency Method and the Second-Harmonic Method," Y. Nakagawa, et al., IEICE Transactions, Vol. E71, No. 8, pp. 799-809 August 1988;
18. "Second Harmonic Imaging and Harmonic Doppler Measurements with Albunex," Chang, et al., 1994 Ultrasonics Symposium, pp. 1551-1554;
19. "In Vivo and In Vitro Ultrasound Beam Distortion Measurements of a Large Aperture and a Conventional Aperture Focused Transducer," Moshfeghi, et al., Ultrasound in Med and Biol., Vol. 14, No. 5, pp. 415-428, 1988;
20. "Physical Acoustics: Ultrasonic Techniques," Makin, J. Acoust. Soc. Am. Vol. 97, No. 5, Pt. 2, May 1995;
21. "Generation of Harmonics in a focused Gaussian sound field," Du, et al., J. Acoust. Soc. Am. 97 (3), pp. 1486-1488, March 1995;
22. "Nonlinear Propagation in Doppler Ultrasound," McDicken, et al., Ultrasound in Med & Biol., Vol. 19, No. 5, pp. 359-364, 1993;
23. "Multi-Frequency Transducer Assembly for Nonlinear Ultrasonic Measurements," Wu, et al., J. Acoust. Soc. Am. 93 (4), Pt. 1, pp. 2231-2234;
24. Schrope, B. et al. (1992) "Simulated Capillary Blood Flow Management Using a Nonlinear Ultrasonic Contrast Agent", Ultrasonic Imaging, Vol. 14:134-158;
25. United States Patent No. 4,012,950, issued to Kompfner, et al., dated March 22, 1977;
26. United States Patent No. 5,608,690, issued to Hossack, et al., dated March 4, 1997;
27. United States Patent No. 5,255,683, issued to Monaghan, dated October 26, 1993;
28. United States Patent No. 5,410,516, issued to Uhlrndorf, et al., dated April 25, 1995;
29. United States Patent No. 5,879,303, issued to Averkiou, et al., dated March 9, 1999
30. United States Patent No. 5,526,816, issued to Arditi, dated June 18, 1996;
31. United States Patent No. 5,724,976, issued to Mine, et al., dated March 10, 1998;
32. United States Patent No. 4,483,345, issued to Miwa, dated November 20, 1984;
33. United States Patent No. 4,620,546, issued to Aida et al., dated November 4, 1986;

34. United States Patent No. 4,865,042, issued to Umemura, et al., dated September 12, 1989;
35. United States Patent No. 5,158,071, issued to Umemura, et al., dated October 27, 1992;
36. United States Patent No. 5,435,311, issued to Umemura, et al., dated July 25, 1995;
37. United States Patent No. 5,034,931, issued to Wells, dated July 23, 1991;
38. United States Patent No. 4,714,846, issued to Pesque, et al., dated December 22, 1987;
39. United States Patent No. 4,702,258, issued to Nicolas, et al., dated October 27, 1987;
40. Ward, B. et al., (1995) "Non-Linear Propagation Applied to the Improvement of Lateral Resolution in Medical Ultrasound Scanners," 1995 World Congress on Ultrasonics, pgs. 965-968;
41. Ward, B. et al. (1997) "Nonlinear Propagation Applied to the Improvement of Resolution in Diagnostic Medical Ultrasound", J. Acoust. Soc. Am. 101 (1): 143-154;
42. Fosberg, F. (1993) "In Vivo Application of Contrast-Enhanced Harmonic Imaging" Radiological Society of North America, Abstract No. 1047;
43. United States Patent No. 5,706,819, issued to Hwang, et al., dated January 13, 1998;
44. Parker, Kevin J., "Observations of Nonlinear Acoustic Effects in a B-Scan Imaging Instrument", IEEE Transactions on Sonics and Ultrasonics, Vol. SU-32: No. 1 (1985);
45. Dunn, et al., (1981), "Ultrasonic Determination of the Nonlinearity Parameter B/A for Biological Media" J. Acoust. Soc. Am. 69(4), pp. 1210-1212;
46. United States Patent No. 5,897,500, issued to Zhao, dated April 27, 1999;
47. United States Patent No. 5,846,202, issued to Ramamurthy, et al., dated December 8, 1998;
48. United States Patent No. 5,833,614, issued to Dodd, et al., dated November 10, 1998;
49. United States Patent No. 5,833,613, issued to Averkiou, et al., dated November 10, 1998;
50. United States Patent No. 5,740,128, issued to Hossack et al., dated April 14, 1998;
51. United States Patent No. 5,577,505, issued to Brock-Fisher, et al., dated November 26, 1996;

52. United States Patent No. 5,396,285, issued to Hedberg, et al., dated March 7, 1995;
53. United States Patent No. 5,313,948, issued to Murashita, et al., dated May 24, 1994;
54. United States Patent No. 5,111,823, issued to Cohen, dated May 12, 1992;
55. United States Patent No. 4,610,255, issued to Shimura, et al., dated September 9, 1986;
56. United States Patent No. 5,456,257, issued to Johnson, et al., dated October 10, 1995;
57. United States Patent No. 5,540,909, issued to Schutt, dated July 30, 1996;
58. United States Patent No. 5,628,320, issued to Teo, dated May 13, 1997;
59. United States Patent No. 5,628,322, issued to Mine, dated May 13, 1997;
60. United States Patent No. 5,632,277, issued to Chapman, et al., dated May 27, 1997;
61. "Modeling Acoustic Field Propagation for Medical Devices" (1993) PhD. Thesis by Dr. Ted Christopher;
62. European Patent Application No. 851 241 A2, issued July 1, 1998;
63. International Application Publication No. WO 96/13213, issued May 9, 1996;
64. European Patent Application No. EP 0770 352 A1, issued May 2, 1997;
65. International Application Publication No. WO 91/15999, issued October 31, 1999;
66. J.Y. Chapelon et al., Ultrasonics, "Bubble Detection and Sizing with a Double Frequency Doppler System" Vol. 26, May 1988, pp. 148-154;
67. D. Cathignol, et al., "Bubble Sizing with High Spatial Resolution" IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, Vol. 37, no. 1, pp. 30-37, January 1990;
68. D.L. Miller "Ultrasonic Detection of Resonant Cavitating Bubbles in a Flow Tube by Their Second-Harmonic Emissions", Ultrasonics, Vol. 19, pp. 217-224, September 1981;
69. International Application Publication No. WO 8002365, dated November 13, 1980;
70. European Patent Application No. EP 226044, dated June 24, 1987;
71. United States Patent No. 6,023,977, issued to Langdon et al., dated February 15, 2000;  
and


72. United States Patent No. 5,415,175, issued to Hanafy et al., dated May 16, 1995.

Copies of U.S. Patents 6,023,977 and 5,415,175 are enclosed herewith. Pursuant to 37 C.F.R. §1.98(d), copies of the other above listed references are not provided, as the references were previously submitted to the Examiner or cited by the Examiner in connection with parent case, U.S. Serial Number: 08/746,360 filed on November 8, 1996. It is noted that a translation of the above-identified Japanese reference, Heisei 8-294487 was also submitted in parent application no. 08/746,360.

Consideration of this Information Disclosure Statement is respectfully requested.

Inasmuch as this Information Disclosure Statement is being submitted in accordance with the schedule set out in 37 C.F.R §1.97(b), no statement or fee is required.

Respectfully submitted,

  
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Form PTO-1449 U.S. DEPARTMENT OF COMMERCE (REV. 7-80) PATENT AND TRADEMARK OFFICE  <b>INFORMATION DISCLOSURE CITATION</b>  <i>(Use several sheets if necessary)</i>				<b>Atty. Docket No. (Optional)</b>  9872Y		<b>Application Number</b>  Unassigned	
				<b>Applicant(s)</b> Ted Christopher			
				<b>Filing Date</b> Herewith		<b>Group Art Unit</b> Unassigned	
<b>U.S. PATENT DOCUMENTS</b>							
EXAMINER INITIAL*		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE (if appropriate)
	1.	4,012,950	3/22/77	Kompfner, et al.			
	2.	5,608,690	3/4/97	Hossack, et al.			
	3.	5,255,683	10/26/93	Monaghan			
	4.	5,410,516	4/25/95	Uhlmdorf, et al.			
	5.	5,879,303	3/9/99	Averkiou, et al.			
	6.	5,526,816	6/18/96	Arditi			
	7.	5,724,976	3/10/98	Mine			
	8.	4,483,345	11/20/84	Miwa			
	9.	4,620,546	11/4/86	Aida			
	10.	4,865,042	9/12/89	Umemura, et al.			
	11.	5,158,071	10/27/92	Umemura, et al.			
	12.	5,435,311	7/25/95	Umemura, et al.			
	13.	5,034,931	7/23/91	Wells			
	14.	4,714,846	12/22/87	Pesque, et al.			
	15.	4,702,258	10/27/87	Nicolas, et al.			
	16.	5,706,819	1/13/98	Hwang, et al.			
	17.	5,897,500	4/27/99	Zhao			
	18.	5,846,202	12/8/98	Ramamurthy, et al.			
	19.	5,833,614	11/10/98	Dodd, et al.			
	20.	5,833,613	11/10/98	Averkiou, et al.			
	21.	5,740,128	4/14/98	Hossack et al.			
	22.	5,577,505	11/26/96	Brock-Fisher, et al.			
	23.	5,396,285	3/7/95	Hedberg, et al.			
	24.	5,313,948	5/24/94	Murashita, et al.			
	25.	5,111,823	5/12/92	Cohen			

26.	4,610,255	9/9/86	Shimura, et al.			
27.	5,456,257	10/10/95	Johnson, et al.			
28.	5,540,909	7/30/96	Schutt			
29.	5,628,320	5/13/97	Teo			
30.	5,628,322	5/13/97	Mine			
31.	5,632,277	5/27/97	Chapman, et al.			
32.	6,023,977	2/15/00	Langdon, et al.			
33.	5,415,175	5/16/95	Hanafy, et al.			

#### FOREIGN PATENT DOCUMENTS

REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO
34.	8-294487	11/12/96	Japan				
35.	851 241 A2	7/1/98	Europe				
36.	WO 96/13213	5/9/96	PCT				
37.	0770 352 A1	5/2/97	Europe				
38.	WO 91/15999	10/31/99	PCT				
39.	WO 8002365	11/13/80	PCT				
40.	226044	6/24/87	Europe				

#### OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*

41.	Averkio, et al., (1995), "Measurements of Harmonic Generation in a Focused Finite-Amplitude Sound Beam", <u>J. Acoust. Soc. Am.</u> 98(6), pp. 3439-3442
42.	Baker, et al., (1997), "Nonlinear Propagation Applied to the Improvement of Resolution in Diagnostic Medical Ultrasound", <u>J. Acoust. Soc. Am.</u> 101(1):143-154
43.	Baker, et al., (1995), "Non-Linear Propagation Applied To The Improvement of Lateral Resolution In Medical Ultrasound Scanners", 1995 World Congress On Ultrasonics, pp. 965-968
44.	Baker, et al., (1988), "The Nonlinear Pressure Field of a Plane Circular Piston: Theory and Experiment", <u>J. Acoust. Soc. Am.</u> 84(4)
45.	Bjorno L. et al., (1982), "Nonlinear Focusing Effects in Ultrasonic Imaging", Ultrasonics Symposium Proceedings, Vol. 2:659-662
46.	Chang, et. al., (1994), "Second Harmonic Imaging and Harmonic Doppler Measurements with Albunex", 1994 Ultrasonics Symposium, pp. 1551-1554
47.	"Errors in Attenuation Measurements Due to Nonlinear Propagation Effect," Zeqiri, <u>J. Acoust. Soc. Am.</u> 91 (5), pp. 2585-2593, May 1992



48.	"Harmonic Generation in Finite Amplitude Sound Beams from a Rectangular Aperture Source," Kamakura, et al., <u>J. Acoust. Soc. Am.</u> 91 (6), pp. 3144-3151, June 1992
49.	"The Enhancement of Second Harmonic Generation In Ultrasonic Microscopic Observation By Triple Transition," Din, et al., 1993 <u>Ultrasonic Symposium</u> , pp. 575-578
50.	"Non-Linearity and Finite Amplitude Effects," <u>European Journal Of Ultrasound</u> , 1 pp. 215-219, 1994
51.	"Time-Shift Compensation of Ultrasonic Pulse Focus Degradation using Least-Mean-Square Error Estimates of Arrival Time," Liu, et al., <u>The Journal of the Acoustical Society of America</u> , Vol. 95, No. 1, pp. 542-555, January 1994
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53.	"Wavefront Amplitude Distribution in the Female Breast," Zhu, et al., <u>J. Acoust. Soc. Am.</u> , 96 (1), pp. 1-9, July 1994
54.	"An Experimental Investigation of the Nonlinear Pressure Field Produced by a Plane Circular Piston," TenCate, <u>J. Acoust. Soc. Am.</u> 94 (2), Pt. 1, pp. 1084-1089, August 1993
55.	"New Approaches to Nonlinear Diffractive Field Propagation," Christopher, et al., <u>J. Acoust. Soc. Am.</u> 90 (1), pp. 488-499, July 1991
56.	"Imaging the Acoustic Nonlinearity Parameter with Finite-Amplitude Sound Waves: The Difference-Frequency Method and the Second-Harmonic Method," Y. Nakagawa, et al., <u>IEICE Transactions</u> , Vol. E71, No. 8, pp. 799-809 August 1988
57.	"Second Harmonic Imaging and Harmonic Doppler Measurements with Albus, et al., 1994 <u>Ultrasonics Symposium</u> , pp. 1551-1554
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59.	"Physical Acoustics: Ultrasonic Techniques," Makin, <u>J. Acoust. Soc. Am.</u> Vol. 97, No. 5, Pt. 2, May 1995
60.	"Generation of Harmonics in a focused Gaussian sound field," Du, et al., <u>J. Acoust. Soc. Am.</u> 97 (3), pp. 1486-1488, March 1995
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62.	"Multi-Frequency Transducer Assembly for Nonlinear Ultrasonic Measurements," Wu, et al., <u>J. Acoust. Soc. Am.</u> 93 (4), Pt. 1, pp. 2231-2234
63.	Ward, B. et al., (1995) "Non-Linear Propagation Applied to the Improvement of Lateral Resolution in Medical Ultrasound Scanners," <u>1995 World Congress on Ultrasonics</u> , pgs. 965-968

	64.	Ward, B. et al. (1997) "Nonlinear Propagation Applied to the Improvement of Resolution in Diagnostic Medical Ultrasound", <u>J. Acoust. Soc. Am.</u> 101 (1): 143-154
	65.	Fosberg, F. (1993) "In Vivo Application of Contrast-Enhanced Harmonic Imaging" <u>Radiological Society of North America</u> , Abstract No. 1047
	66.	Parker, Kevin J., "Observations of Nonlinear Acoustic Effects in a B-Scan Imaging Instrument", <u>IEEE Transactions on Sonics and Ultrasonics</u> , Vol. SU-32: No. 1 (1985)
	67.	Dunn, et al., (1981), "Ultrasonic Determination of the Nonlinearity Parameter B/A for Biological Media" <u>J. Acoust. Soc. Am.</u> 69(4), pp. 1210-1212
	68.	"Modeling Acoustic Field Propagation for Medical Devices" (1993) PhD. Thesis by Dr. Ted Christopher
	69.	J.Y. Chapelon et al., <u>Ultrasonics</u> , "Bubble Detection and Sizing with a Double Frequency Doppler System" Vol. 26, May 1988, pp. 148-154
	70.	D. Cathignol, et al., "Bubble Sizing with High Spatial Resolution" <u>IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control</u> , Vol. 37, no. 1, pp. 30-37, January 1990
	71.	D.L. Miller "Ultrasonic Detection of Resonant Cavitating Bubbles in a Flow Tube by Their Second-Harmonic Emissions", <u>Ultrasonics</u> , Vol. 19, pp. 217-224, September 1981
	72.	Schrope, B. et al. (1992) "Simulated Capillary Blood Flow Management Using a Nonlinear Ultrasonic Contrast Agent", <u>Ultrasonic Imaging</u> , Vol. 14:134-158
EXAMINER		DATE CONSIDERED
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.		